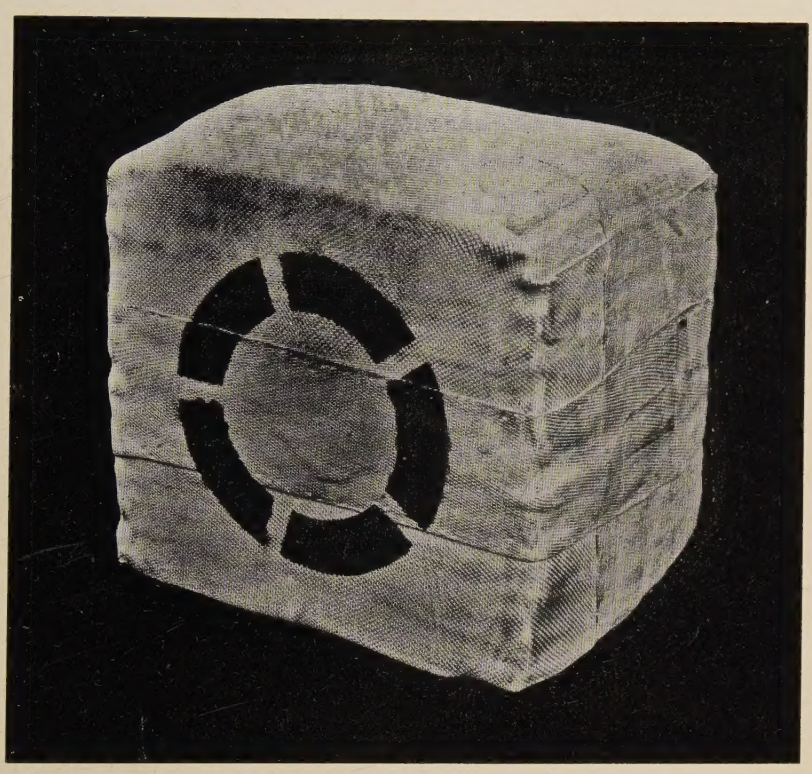
THE RUBBER RESEARCH INSTITUTE OF MALAYA'S

PLANTERS' BULLETIN



NEW SERIES NUMBER TWO

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RUBBER RESEARCH INSTITUTE OF MALAYA
INCORPORATED 1925

September
1952

RRI

LOCATION The Institute's Laboratories and Offices are at the third mile, Ampang Road, Kuala Lumpur.

CORRESPONDENCE All *letters* must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of a particular officer, if so desired (See Staff List in Bulletin No. 1, page 24). The address for *telegrams* is Searching, Kuala Lumpur. *Telephone:* Kuala Lumpur 3351/2/3. *Parcels* occassionally arrive without any indication of their origin. It is requested that senders will write their names and addresses clearly on the outside of all packages, and also advise the Institute by letter or telegram of their despatch. This is especially important for perishables, such as latex samples and plant specimens.

PROHIBITED PLANT SPECIMENS Attention of planters and others in territories outside the Federation of Malaya and the Colony of Singapore is drawn to the Malayan Plant Importation Rules which prohibit the importation into Malaya of any part of a plant, whether living or dead, unless it is accompanied by a permit issued by the Director of Agriculture, Federation of Malaya. No permit will be issued in respect of any diseased plant or any plant pest. Any plant imported in contravention of these Rules (whose object is to prevent the introduction of diseases or pests) will be destroyed without examination. Anyone outside Malaya who desires our advice on pests or diseases or any other matters that may require examination of living material must first submit an inquiry by letter giving the fullest possible description of their problem.

ADVICE Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. *Interviews* should be arranged by letter or telephone, as members of the senior research and advisory staff are frequently absent on visits to plantations. The Institute is open from 8 AM to 1 PM and 2 PM to 4 PM on Mondays to Fridays, and from 8 AM to 12.30 PM on Saturdays.

EXPERIMENT STATION AND FACTORY This station of the RRI is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur — Kepong — Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement with the Director of the Rubber Research Institute (see *Correspondence* above). There is a guest house.

THE RUBBER RESEARCH INSTITUTE OF MALAYA'S

PLANTERS' BULLETIN

Kuala Lumpur September 1952 New Series No. 2

Editorial: The Chemical Division

The Chemical Division of the Institute is concerned with many different aspects of rubber production ranging from broad principles of chemical engineering on the one hand to detailed investigations in colloid science on the other. Much of the work is closely related to advice to estates in solving difficulties as they arise, but at the same time research investigations with a longer term objective are being untertaken.

The problems studied range from simple practical ones, for example methods of determining the dry rubber content of latex, or of reducing the time required to dry smoked sheet, to complex research investigations, such as studying the structure of the rubber molecules in the hope of modifying them to provide new forms of rubber to meet presentday technical requirements and thus to capture new markets.

Much of the work begins at a very practical level and with simple aims, but in the course of solving the problems, we often find ourselves involved in fundamental scientific studies, where new ground has to be broken before we can answer apparently simple questions. It is our intention to inform our readers not only of matters of immediate practical value and interest in estate and factory practice, but also to convey some idea of the progress made in achieving the objectives of more fundamental investigations.

This number of the Bulletin is concerned with some practical developments of the work of the Chemical Division. Accounts of other lines of work will appear from time to time in future issues.

Attention must be drawn to one very important aspect of our work: the technical classification of natural rubber. The first two articles in the present Bulletin deal with this topic, one giving a general picture of the situation to date, the other detailing the procedure to be followed by estates wishing to participate in the scheme.

This development appears to us to be of great practical importance to the natural rubber producing industry. We have been told again and again that the greatest difficulties the manufacturer meets in using natural rubber arise from variability in its technical or processing qualities. In this respect natural rubber is said to be inferior to synthetic rubber, which is marketed in neat packages bearing information on its technical properties. It seems evident that, by technical classification, producers should be able to meet this criticism and supply natural rubber in consignments of uniform quality.

This is a first step; in studying methods of classification the causes of variability become more clearly understood. New information thus gained may be used to modify the properties of our product in useful directions and lead to an increase in the range of its applications.

Meeting the Consumers' Requirements

WITH THE EXISTING METHOD of visual grading, information is given to the manufacturer on the appearance and to a certain extent the dirt content of the rubber. It is however possible to purchase two apparently similar consignments of rubber, even from the same source, and find that they behave in an entirely different manner in factory operations. In other words the two consignments may have completely different technological properties. The technical classification scheme is meeting the consumers' requirements by providing rubber marked with particular symbols which give information about the physical properties of the rubber in both the raw and vulcanised states. Thus the manufacturer knows that within reasonable limits, all the bales marked with a certain symbol will be uniform with regard to their behaviour in his factory. Some manufacturers have proved this to their own satisfaction and a fair number are now purchasing when possible all their R.S.S. 1 & 2 from classified sources in order to gain this advantage.

THE NEED FOR TECHNICALLY CLASSIFIED RUBBER

To appreciate more fully the need for Technically Classified Rubber (hereafter referred to as T.C.R.) it is instructive to examine a typical routine adopted by manufacturers when producing rubber articles by a continuous process. When the rubber enters the factory each bale of rubber is usually divided by a mechanical cutter into six or eight segments; each of these segments may be placed in a separate bin. When the bins are full, their contents can be regarded as uniform with respect to each other. Each bin is processed separately and the compounding ingredients added to a specified formula. The compounded rubber stock is sheeted or extruded into a suitable form for assembly and/or vulcanisation. Control samples are taken from the material at this stage and check tests carried out to determine if the compound has the correct physical properties. Marked variations in the natural rubber as well as those due to variations in compounding ingredients are generally indicated at this stage; those batches of compound which are not satisfactory are rejected and sent back for modification. If the manufacturer had a uniform natural rubber, as he has with its synthetic counterpart, and provided that his compounding ingredients and processing procedures were carefully controlled, these rejected batches would occur less frequently. T.C.R. can provide this uniform material. It supplies information to the manufacturer on the physical properties of the rubber and enables him, by making his purchases in one of the nine grades described later, to maintain continuous production without blending and with reduced controls and rejects, independent of the source of the rubber. For small manufacturers the provision of T.C.R. is of no less importance. With more limited technological control, the rejection is usually of the end product rather than of a batch of compound, and this means an increase in costs.

HISTORICAL DEVELOPMENT

For many years it has been realised that the existing grading system for natural rubber, based on visual inspection, has serious limitations. In 1949 the French delegation put forward to the International Rubber Study Group in London their proposals for 'Specified Rubbers'. These proposals were received with enthusiasm by the representatives of the

producers in Malaya and other countries and a programme of intensive work on the subject was commenced in most of the producing countries.

In Malaya an extensive survey of the ribbed smoked sheets produced on estates was commenced and over 2,000 separate samples were examined. The results indicated that firstly there was a considerable variation in the physical properties of the rubber within any one R.M.A. grade, secondly there were significant differences between sheets taken from the same bale. Since the bale forms the most convenient unit for manufacturers (bales are rarely used sheet by sheet), a sampling method dependent on the bale was developed. The results of tests on bale samples indicated that the differences between bales produced on the same estate are small provided that the production processes on the estate are fairly well controlled.

In 1951, although only relatively small quantities of T.C.R. were being received by manufacturers, the International Study Group in Rome was able to report a favourable reception but it was then apparent that progress was dependent on the provision of considerably larger quantities of classified rubber.

DEVELOPMENT OF T.C.R. IN MALAYA

Early during 1951 contact was made with those estates in Malaya which had already been participating in the sheet survey and in about March 1951 the existing scheme started to develop rapidly. In *Figure 1* the number of estates cooperating is recorded against the time. It will be noted that there was a rapid rise until September 1951. On or about this time producers having put considerable effort into the classification of their rubber were wanting to know the consumers' reactions towards this new product and further growth was restricted by the limited number of reports which were made available. About March 1952 information began to get back to the producers that T.C.R. was being received favourably and that sometimes the subsequent demand was backed by a small premium. Following this reaction there was a sudden rise in the number of estates due to some agencies introducing new estates and new agencies deciding to provide T.C.R. The slight decrease in the number of estates in the period December to April is mainly due to wintering. Sometimes this makes it impossible for estates to be classified continuously due to violent but temporary fluctuations in the physical properties of the rubber. A few estates with limited experience in the scheme were discouraged and dropped out during this interval.

The number of estates actually capable of producing T.C.R. are also shown in *Figure 1* and it will be seen that about half of those cooperating are being classified. This proportion may seem somewhat low, but when the total number of estates cooperating in May 1952 is subdivided into various groups, it will be seen that a large proportion are awaiting initial classification, which takes about a month from the date of initial entry. Only a few of the estates, about 20%, are temporarily not producing T.C.R. because of the increased variability of their rubber or because they are awaiting modifications to estate machinery, end of wintering, *etc*, before sending further samples.

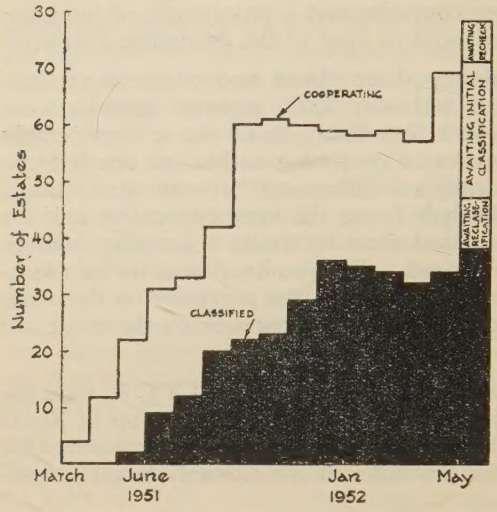

Figure 1. The rise in number of estates cooperating in the scheme for Technically Classified Rubber.

Production figures in tons per day for the period May 1951 to May 1952 are given in *Figure 2.* The general form follows that of the number of estates classified, as would be expected. It is emphasised that these figures are approximate and are based on the estimated daily output of the estates in bales. There are several factors beyond the control of the R.R.I. which have in the past prevented the total potential output of T.C.R. coming onto the market. For example, on one occasion the shipping authorities erased the technical classification symbols from the bales as 'illicit' markings and sent a bill to the estate for the labour involved.

On another occasion during 1951 a considerable quantity of rubber was not marked because authorisation from the parent organisation was not forthcoming. It is hoped that now, however, the quantity given does represent a reasonable estimate of the Malayan rubber which is being sold and used as T.C.R.

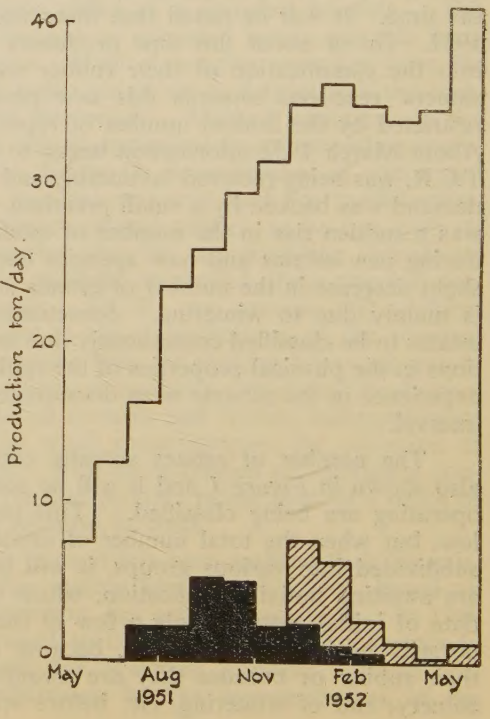

Figure 2. Development of the Production of Technically Classified Rubber.

Blue: Solid Shading
Yellow: Not Shaded
Red: Light Shading

The more important physical property, as far as the consumers are concerned, is the vulcanisation characteristic. This is mainly due to the Mooney viscosity of the rubber altering during shipment and storage. The variation would not matter if it was similar for all the grades of Mooney viscosity but unfortunately the variations are not uniform and it seems possible that the harder of two rubbers measured in Malaya may well become the softer rubber when examined in the consumer's factory. For this reason, only the quantities of the different vulcanisation grades are indicated on *Figure 2;* the unshaded portion represents that rubber classified in the Yellow (or medium) grade and that falling in the Blue and Red (high and low grades) is shown solid and shaded respectively. The medium grade has predominated throughout the development in Malaya and the proportion of other grades is relatively small. The distribution in other producing countries indicates greater proportions in the Red and Blue grades.

The history of the production and development of classified rubber in Malaya would not be complete without some mention of the considerable achievements of Messrs Socfin & Co, Ltd, who commenced production in 1950 and have been responsible for a large quantity of this type of rubber being available since that time. The figures for their production are not included in this paper, only those estates which are using the testing facilities available at the R.R.I. have been drawn upon in the compilation of *Figures 1* and *2.* It is interesting to note that the combined production of T.C.R. in Malaya now exceeds that of any other single producing country.

PRACTICAL APPLICATION OF THE TECHNICAL CLASSIFICATION SCHEME

Full details of the Technical Classification scheme are given in the article on page 39; a brief outline only is included here, stressing the practical application of the scheme.

Once an estate has decided to classify its rubber it must send a continuous supply of bale samples cut from the edges of bales chosen at random from the production. The bale samples are sent to the R.R.I. in sample bags attached to which are labels on which is recorded the name of the estate, the date of harvesting the latex and the date on which the sample was taken. This data is the sole means of identifying samples and it is important that it should be recorded clearly on the labels, since it facilitates the investigation of any periodic abnormalities in the harvesting or processing which may affect the physical properties of the rubber.

Physical tests are carried out on the samples by the testing station to determine both the Mooney viscosity of the raw rubber and the modulus of the vulcanised rubber. The results of both tests are recorded on the estate control chart, each day's samples being treated separately. In this manner it is possible to keep a check on the production of the estate and as long as the level of the properties are within certain defined limits the production can be classified and all bales produced by the estate marked with one of the nine classification symbols, irrespective of the destination of the rubber. If for any reason the physical properties of the rubber become too variable, instructions are sent to the estate to cease bale marking until control has been re-established. Meanwhile the

the estate must continue to send bale samples at the prescribed frequency, even though the production is not being classified. Since there is a time lag of several days between the receipt of the samples and the results of the tests becoming available, it is essential that the samples are despatched regularly and with as little delay as possible after cutting from the bales. In this manner, if the physical properties of the rubber vary too much and some of the daily production is not within the class limits of the symbol being used on the bales, only a few bales from the estate will be despatched incorrectly classified before the estate stops bale marking.

EXTENSION OF TECHNICAL CLASSIFICATION TO LOWER GRADES OF RUBBER

If the technical classification scheme is to develop more rapidly, the lower grades of rubber must also be available in the classified range. Most tyre manufacturers use a comparatively small percentage of R.S.S. 1 & 2 and it is futile, except for special requirements, to use a special uniform grade of R.S.S. 1 and mix it with quantities of unclassified lower grades of rubber. With this in mind the R.R.I. have investigated the possibilities of producing technically classifiable rubber from the output of packing houses and from remilling factories. Classification has been found practicable for packing houses by comparatively small modifications to the packing procedures, which enable a blended bale to be produced from the heterogeneous rubber entering the packing house. Whereas the variations between sheets within a bale are large the differences between bales are reduced sufficiently to permit classification. The rubber thus produced is similar in physical properties to estate rubber in the same technical class. There is a considerable interest in these technically classified lower grades of rubber and both American and British manufacturers are anxious to arrange for consignments.

THE FUTURE OF TECHNICAL CLASSIFICATION

The consumer demand for T.C.R. has been considerably in excess of the supply with the result that all grades have been sold to a large extent independent of the particular classification. This is partly due to the manufacturer prefering to buy rubber with known technical properties rather than unclassified rubber, and partly due to consumers' interest in evaluating the various grades. However manufacturers are begining to ask for specific grades, to suit their particular compounding and processing techniques. Foreseeing this development a number of experiments have been carried out on estates in an attempt to modify the physical properties of the rubber produced, both by slight alterations in the estate procedure and also by small innocuous additions to the latex. The success of these experiments indicates that it may be possible in the future to alter the physical properties of the rubber at will, and so produce rubbers to meet the requirements of the manufacturers. It may also be possible thus to overcome the variations brought about by wintering and other factors. By such improvements the competitive position of natural rubber with regard to synthetic rubbers can be considerably improved.

CHEMICAL DIVISION

Technical Classification of Rubber: Estate Procedure

IN a previous report (Report on Technical Classification of Natural Rubber in Malaya, *J. Rubb. Res. Inst. Malaya,* 14 (1952), *Communication 277 for April 1952) it was demonstrated that a practicable system of technical classification for Malayan rubber has been developed and is in fact, already being applied on a commercial scale in respect of estate produced sheet. The present communication sets out the procedure when technical classification is applied to estate production of R.S.S. and gives in brief the requirements to be fulfilled by producers, agency houses and shippers for the satisfactory functioning of the scheme. Some of this information has previously been distributed in the form of leaflets and circular letters, but is summarised here in a convenient form. Additional matter has been included where it appeared necessary in order to provide a coherent description.*

INTRODUCTION

Comprehensive surveys of estate produced Ribbed Smoked Sheet throughout the Federation have established that the variation in technical properties of the rubber produced by different estates can be very large; variation in the properties of the rubber produced by any particular estate from day to day, however, is considerably smaller. By taking samples regularly from the output of a given estate it has proved possible to apply the control chart system to check that the properties of the rubber produced are maintained within definite limits; the technical classification of estate produced rubber, as developed for Malaya by the Rubber Research Institute, is based upon this principle.

INFORMATION REQUIRED FROM ESTATES WISHING TO COOPERATE

2. On applying this scheme for technical classification to a given estate, the first requirement is to establish the level and variability of the rubber quality. The level indicates the technical class into which the rubber falls and the variability indicates whether the bales are sufficiently alike to warrant classification of the whole production. Estates wishing to have rubber technically classified are therefore requested to forward the following information to the testing station:

a The approximate number of bales of R.S.S. of each R.M.A. grade produced per day.

b The number of divisions and factories on the estate which may be considered as separate production units. If there is more than one such unit, the number of bales produced by each unit should be given.

c The tapping system(s) employed on the estate.

d Estimated period for which the estate will be producing sheet.

In order that the maximum output can be obtained from the existing testing facilities, estates are requested to agree to the marking of all bales once the output has been classified.

INITIAL SAMPLING PROCEDURE

3. When an estate has decided to submit its production for classification, it is required to test samples covering all tapping tasks in use on the estate, so that an estimate of the variability of the estate's production can be made. When alternate daily tapping is in operation the following bale samples should be taken:

a On two consecutive days bale samples from every bale of Ribbed Smoked Sheet produced by the estate.

b On the subsequent eight days bale samples on the basis of one bale for every ten bales produced, but not less than two bale samples should be taken on any one day. Thus estates producing up to 24 bales per day should submit two samples on any one day; when 25 to 34 bales are produced, 3 samples are required; when 35 to 44, 4 samples, and so on.

Where other systems of tapping are in operation, such as third or fourth daily, a different procedure may be followed details of which will be forwarded by the testing station.

4. These two batches of bale samples should be despatched as soon as they are available to the testing station, at present at the Rubber Research Institute of Malaya, Kuala Lumpur. Thus an estate producing seven bales per day will send fourteen bale samples taken on two consecutive days followed later by sixteen samples, taken at a rate of two per day, on the subsequent eight days.

5. Samples of the normal rubber produced on the estate are needed and should be taken from bales in accordance with the following instructions. The entire length of one edge of the finished and wrapped (but untalced) bale is cut off to form a triangular section having an approximate weight of 2 lb. With a standard bale of Ribbed Smoked Sheet an 'edge' sample with dimensions about $2'' \times 2'' \times 3''$ triangular cross section and 19″ long has the appropriate weight. The cut should be made with a sharp *dry* knife* through the full height of the bale at right angles to the plane of the sheets, *i e* the bale should be standing with the sheets horizontal and parallel to the floor (NOT with the sheets vertical), the cut being made downwards through the bale. The operation is facilitated if the bale sample is pulled away from the bale during the process of cutting *(Figures 1, 2* and *3).*

6. The sample is then placed in a sample bag on the label of which should be written:

a The date of harvesting the latex.

b The date on which the sample was taken.

c The name of the estate or division.

7. Wrapping sheets, equivalent in weight to the sample removed from the bale, are then spiked over the cut corner of the bale. This operation both repairs the bale and makes it up to weight; repairs have been found more effective if carried out on the untalced bale. A repaired bale is shown in *Figure 4.*

**A wet knife should not be used since the moisture may cause mould to develop in the interior of the sampled bale.*

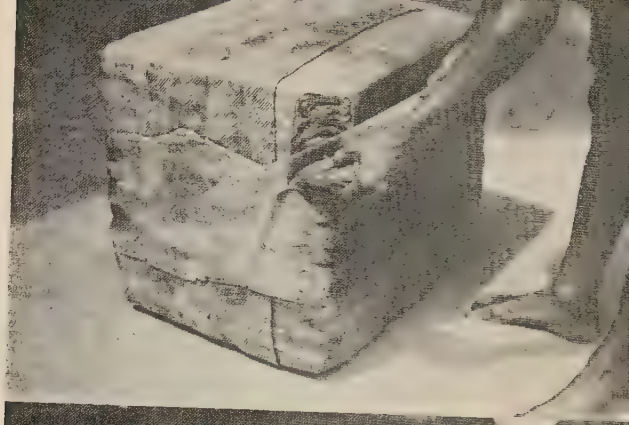

Figure 1.
Commencing the sample cut.

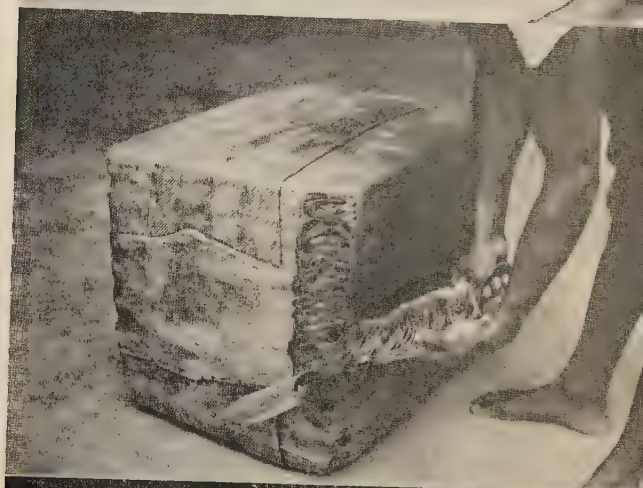

Figure 2.
Sample cut almost complete.

Figure 3.
Bale sample.

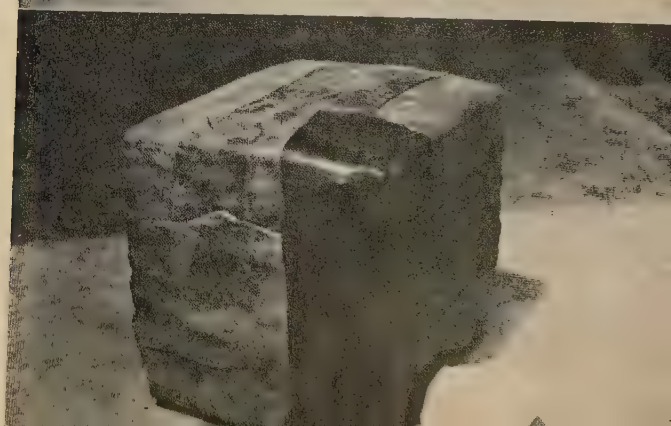

Figure 4.
Repaired bale and labelled sample bag.

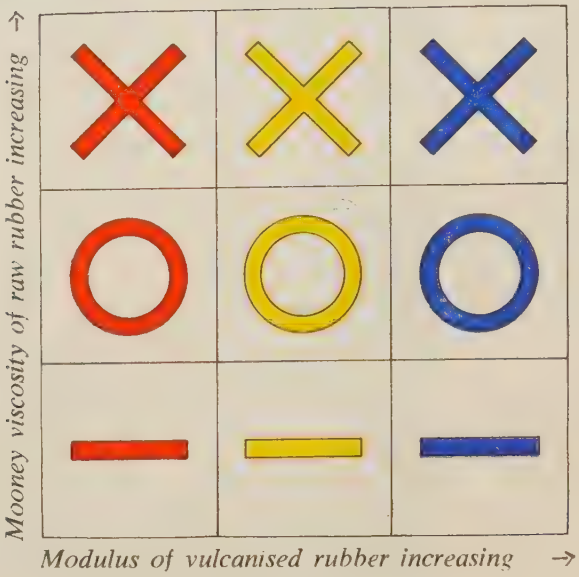

Figure 5. The nine grades of Technically Classified Rubber

TESTS ON THE BALE SAMPLES

8. When each bale sample is received at the testing station, the wrapping sheets are removed and the remainder is homogenised by passing through a two roll horizontal mill several times under standard conditions. A small portion is then taken from the blended sample, which represents the whole bale from which it was removed, and a physical test known as the Mooney viscosity test* carried out to determine the ease with which the raw rubber can be processed. A further portion of the blended sample is mixed with compounding ingredients and vulcanised in the form of a dumbbell test piece which after a suitable interval of time is stretched under a fixed load and the increase in length measured. From this latter measurement is derived the modulus of the rubber. On this property the vulcanised characteristic of the classification scheme is based.

9. By means of similar tests carried out on all the bale samples it is possible to decide if the physical properties of the rubber from the estate are sufficiently uniform to permit classification. There are three grades for each property which are denoted by coloured symbols. The shape of the symbol indicates the limits within which the Mooney viscosity characteristic of the rubber falls, while the colour of the symbol corresponds similarly with the vulcanisation characteristic. Thus there are, at present, nine possible grades into which the physical properties of the rubber can fall; these are shown in *Figure 5* with the appropriate symbols and colours.

** This test is likely to be superceded in due course.*

NORMAL SAMPLING PROCEDURE

10. If the original tests on the bale samples from the estate indicate that the physical properties of the rubber are relatively uniform and there is no danger of some of the rubber produced being outside the classification limits of the relevant class, the estate is justified in marking all the bales produced. To ensure that this uniformity is maintained the estate is required to forward samples taken daily from bales selected at random, representing 10% of the production; in no instance should *less than two bale samples* be taken on any one sampling day. This sampling frequency is continued for a period of about a month. If the physical properties of the rubber remain uniform throughout this period the sampling frequency may then be reduced to twice weekly, the samples being taken on any two consecutive days in the week; sampling must be maintained at this minimum level as long as bales are being marked.

11. If the results of the physical tests indicate that not all of the estate rubber will always be within one class then no classification symbol is allocated to the estate. Sampling may be continued for a further period or alternatively the estate may take fresh samples after a month or so. If the variability is still excessive the production processes of the estate are examined in greater detail. Some of the factors which are thought to be responsible for variations in physical properties are:

Large differences in the geographical location of the divisions

Excessive rain

Wintering, evidenced by defoliation and refoliation of the rubber trees; this phenomenon has been found particularly troublesome when the various stages of wintering are not uniformly distributed over the estate at the same time

Different tappers, *e g* Indian payroll and Chinese contract tappers

Tapping of areas of different clonal types on different days

Variation in the types of tapping cuts, tapping periods and cycles

Use of different types of anti-coagulants

Coagulation at different D.R.C's and at different degrees of acidity of the serum

Some of these factors can be eliminated by the bulking and blending of the latex prior to coagulation, or alternatively by blending of the sheet during bale packing.

INSTRUCTIONS FOR BALE MARKING

12. Once the output of rubber from an estate is classified all bales are marked as they are produced, they are *not* held in stock unmarked until the results of that particular day's samples are available. A suitable stencil, stencil brush and the initial supply of stencil ink are provided by the testing station. Further supplies of stencil inks can be obtained through commercial channels; Messrs James Warren & Co, Ltd, Kuala Lumpur, supply a suitable water soluble ink.

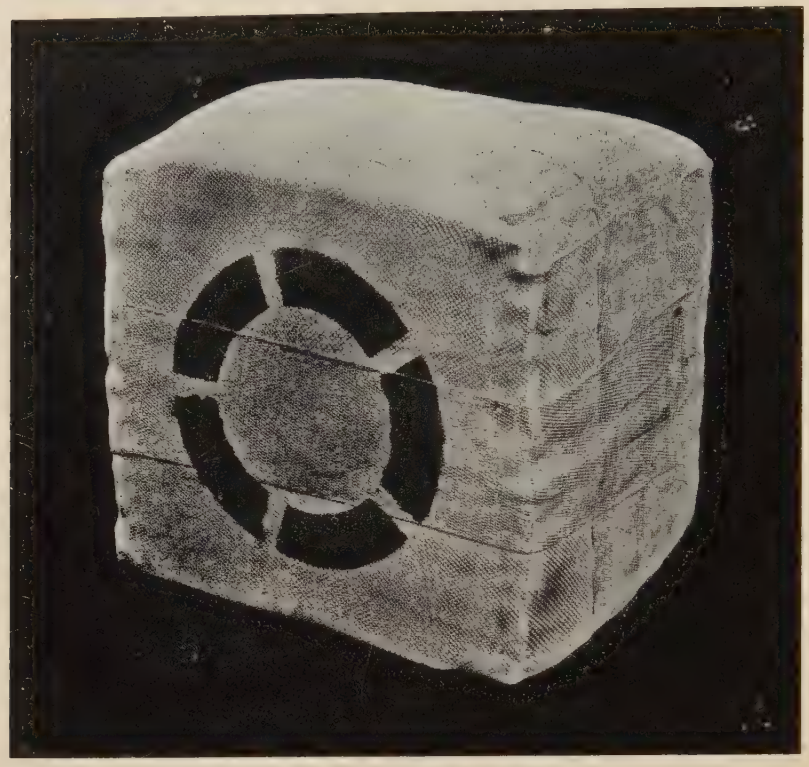

Figure 6. A Yellow Circle bale.

13. The bale marking should be carried out in the following manner:

a Apply a thin coat of bale coating solution to each bale, as with normal production.

b When the bale coat is dry, lightly brush off any excess and then stencil the appropriate symbol in the centre of two of the faces of each bale. A Yellow Circle is shown stencilled on the face of a bale in *Figure 6*.

14. If possible the symbols should be stencilled on opposite faces of the bales. However, since the requirements of different marketing organisations may vary, two adjacent faces may have to be used. There has been no objection to the class mark appearing on the same face as the words, 'Produce of British Malaya' and the choice of faces is left to the discretion of the estate manager.

INTERRUPTION OF BALE MARKING

15. If the test results indicate that some of the rubber produced by the estate is outside the class limits, bale marking must cease. Then the estate is notified by the testing station and asked to confirm

that bale marking has been stopped. The estate should continue to take bale samples and as soon as uniformity of physical properties of the rubber has been re-established, the estate will be informed and bale marking should be resumed. The new symbol may differ from that previously used, since the characteristics of the rubber can change sufficiently to move from one class to another. If an estate temporarily withdraws from the scheme due, for example, to sheet production being stopped, it may be necessary to repeat a complete check on the estate output before the estate can recommence bale marking.

DOCUMENTATION 16. To ensure that technically classified rubber is not directed into the American stockpile certain precautions must be taken with shipments from Malaya:

a All shipments of technically classified rubber to the U.S.A. must be on separate bills of lading.

b The bills of lading and the provisional declaration must state that the consignment consists of bales of technically classified rubber, giving the quantities and technical classes present.

c Agency houses should send monthly to the Rubber Research Institute the following details of rubber shipments to America, for forwarding to the Director of the Rubber Division of the U.S. Government Administration:

(*i*) Estate.
(*ii*) Invoice Number.
(*iii*) R.M.A. Grade.
(v) Number of bales.
(*iv*) Technical Classification.
(*vi*) Destination.
(*vii*) Consignee.
(*viii*) Vessel.
(*ix*) Date of Despatch.

17. In entering into forward contracts for technically classified rubber, estates and agencies are advised not to specify the precise technical classification but solely that the rubber is technically classified. There have been several instances where forward contracts have been made for a particular classification and the physical properties of the rubber as produced on the estate have changed by the time the contract was due, making it difficult for the estate to fulfil its obligations.

18. In order to give the consignee additional information as to the type and quantity of rubber being shipped it is recommended that the rubber should be described on the invoice as 'Technically Classified Rubber' in addition to the normal designation. The class mark or marks should also be recorded on this document, with the quantities of each present in the consignment.

Reprints of this article may be obtained on request.

CHEMICAL DIVISION

A New Rubber to Replace Leather

ONE OF THE ADVANTAGES of the synthetic rubber industry is its capacity for producing special elastomers 'tailored' to suit the needs of a special user. Such products are not necessarily cheap, but have outstanding properties in one direction that justifies their use on a large scale. An example is the range of oil resistant synthetic rubbers which are used almost universally for petrol and oil leads. Modern shoe soling compounds, based on a special synthetic rubber, are now very widely used in the United States, and are rapidly displacing leather. These compounds are vastly superior to the old style rubber soles and heels, and resemble leather in appearance and in comfort in wear. In the United Kingdom, the leather available for shoe soling is very highly priced and is generally reported to be of poor quality. An alternative shoe soling material that was really satisfactory would have a wide and steady sale; experiments have already been started with small quantities of imported synthetic rubbers.

CYCLISING Although natural rubber is a readymade product, this does not mean that its properties cannot be varied by suitable chemical treatment. Modern techniques make it possible to treat rubber as one of the raw materials for a chemical factory, and so to alter and build up the basic chemical structure to give a wide range of extra properties. One such process is that of 'cyclising' rubber. Cyclised rubber when compounded with ordinary rubber gives a material which has properties similar to those of the synthetic rubber used in shoe soling compositions. Trials suggest that it can be used successfully for this purpose.

Cyclised rubber has quite a long history, and has been used on a small scale for several years. It is especially suited for rubber to metal bonds, and has also been used to reinforce natural rubber. The process used has been to treat rubber as solid, or in solution, with hot sulphuric acid. This causes the fundamental structure of the rubber to alter, and the term 'cyclised' rubber comes from the physicochemical nature of this change. The sulphuric acid does not become combined with the rubber, as sulphur does in vulcanisation, but acts as an agent to bring about the changes in the rubber structure. The use of rubber as such, or in solution, involves expensive plant and solvents, and is any way an inefficient process. Large scale production has only been made commercially practicable by discoveries which make it possible to produce cyclised rubber directly from latex.

Surface active agents now available enable latex to be stabilised against strong acids, and the process of cyclisation can be carried out by adding concentrated sulphuric acid to a stabilised latex. The mixture is heated under carefully controlled conditions, and then the latex is coagulated. The last stage is by no means simple, as a latex which will tolerate heating with 60% sulphuric acid is an extremely stable system. Satisfactory coagulation was finally achieved by neutralising the original surface active agent with another of an opposing nature.

The process of cyclising rubber involves the use of dangerous chemicals, and needs very careful control of temperature. If the temperature is a few degrees too low, cyclisation is not complete. Too high

a temperature causes the reaction to get out of control, and the whole batch is spoilt. Cyclising rubber is, however, a comparatively simple problem in chemical engineering, although it needs equipment and facilities of a specialised nature.

In the process at present being developed, a masterbatch is made by coagulating normal latex in the presence of cyclised rubber latex. This gives a very good dispersion of cyclised rubber in the final sheet. The coagulum can be sheeted and dried in the normal way, and can be compounded and worked by normal rubber machinary. The mixed product can be vulcanised and moulded using the ingredients and cures familiar to the rubber trade.

The development of this process is an example of cooperation between various rubber research organisations. The use of surface active agents to stabilise rubber was discovered independently by Rubber-Stichting in Holland, and the Dunlop Rubber Co in England. Subsequent work was done by the British Rubber Producers' Research Association in England, who developed the process to the stage when large scale experiments were justified. Rubber Technical Developments, an offshoot of the British Rubber Producers' Research Association and the British Rubber Development Board, have set up a pilot plant and have so far produced over a ton of masterbatch. This material has been examined by the British Rubber Producers' Research Association, the British Boot, Shoe and Allied Trades Research Association, and many of the leading manufacturers of solings, and has been shown by actual wearing trials to be as suitable for the purpose as the American synthetic compounds.

PILOT PLANT AT SUNGEI BULOH

All the work carried out in Europe has had to be done on ammonia preserved concentrated latex. It is well known that ammonia preserved latex differs fundamentally from fresh latex, and the possibility of commercial production of cyclised rubber in Malaya is now being studied by the R.R.I. Laboratory trials have been carried out by Dr. G.F. Bloomfield who was seconded from the British Rubber Producers' Research Association for a short period to work on this problem. It has been shown that the European process can be modified to give satisfactory products with fresh latex. The next stage is the erection and operation of a pilot plant at the Rubber Research Institute's Experiment Station so that a large scale process can be worked out, and enough cyclised rubber produced to enable large scale trials to be made by manufacturers and users. The final opinion on any new product is passed by the people who buy it, and only by having enough material available for large scale trials, can consumers decide whether a new product is all that is claimed for it. Should cyclised rubber come up to expectation, a large and steady demand will be created for this new rubber product.

Further work is being carried on at the various research institutes to find other uses for cyclised rubber, which has possible applications in many different fields.

CHEMICAL DIVISION

Precoagulation of Latex

THE IMPORTANCE of this subject to planters is borne out by two main facts, first, the very considerable amounts of low grade rubber caused by precoagulation, and second, the disorganisation of latex collection during wet weather which enhances the phenomenon. It is also well known that much inconvenience occurs during the wintering season.

NON-RUBBER CONSTITUENTS What do we understand of the nature and causes of precoagulation? Broadly speaking, it is due to changes taking place in the latex non-rubber components and manifests itself in numerous ways, such as lumps in the tapping cup, clots in the latex, complete coagulation during transportation and fermentation bubbles in the coagulum.

To explain this breakdown, which is analogous both to the clotting of blood and to the souring of milk, it is necessary to know something of the characteristics of latex. Like many biological liquids, it is a colloidal suspension of particles in water containing dissolved substances. In latex, the suspended bodies are rubber particles stabilised by a surrounding protein layer which produces an electric charge on the particles and helps to maintain them in a dispersed condition. There are also other bodies known as lutoids, because of their yellow colour. The continuous aqueous phase (serum) contains dissolved sugars, proteins and salts.

Immediately on exudation of the latex after tapping, the mechanism of natural clotting begins, as in blood, by the activation of enzymes already present in the latex. Enzymes, like vitamins with which they are associated, are present in all living tissue in very small quantities and are essential for all life processes. Among other things, they act in latex by altering the structure of the protein stabilising layers, thereby allowing amalgamation of the rubber particles, that is, coagulation. Recent work at the Rubber Research Institute has shown that the lutoids coagulate first and may separate out with associated rubber particles to give the familiar 'yellow fraction'. This is probably what happens during lump formation in the tapping cup.

BACTERIA The amounts of these important non-rubber constituents in latex, and consequently the resistance to spontaneous coagulation, vary greatly from latex to latex depending on age, type of tree, type of soil, and other ecological conditions. If the latex is a highly stable one, then another mechanism of breakdown asserts itself, about six or twelve hours after tapping. Bacteria from the atmosphere, containers, *etc*, pollute the latex in a manner similar to that giving rise to milk fermentation. They react mainly on the sugars and proteins dissolved in the serum, forming acids and putrid substances. Multiplication of these acidic materials will eventually coagulate the latex by neutralising the electric charge on the particles. A small amount of fermentation in the latex will produce bubbles in sheet rubber during drying.

The two factors involved in the precoagulation of latex are thought to be, therefore, *1*, spontaneous clotting of latex by enzymes destabilising the proteins round the rubber particles and *2*, production of acids by bacteria. It remains for us to consider how wet weather affects these mechanisms.

WET WEATHER AND WINTERING

It is obvious that the wetting of the trees has a major effect and it has been shown recently at the R.R.I. that water soluble bark substances when washed into the latex are a direct cause of premature clotting. The substances involved are tannins and metallic salts, such as those of calcium or magnesium. Tannins react with proteins (for which purpose they are employed in the leather industry for the treatment of hide) and thereby destabilise the rubber particles. The metallic salts probably activate the native latex enzymes and accelerate the spontaneous clotting process. They also react with proteins.

Precoagulation during wintering is most likely connected with the alteration of the tree metabolism and, hence, of the relative amounts of non-rubber substances in the latex, leading to a decrease in stability.

REMEDIES

The foregoing discussion helps us to understand the processes involved and so to devise remedies which, of course, are the rubber growers' main interest. One solution to the problem would be to produce trees giving latex of high stability. This is another problem for the botanist, adding one more item to his already crowded programme. Another fundamental approach might be by injection of the tree with chemicals as done by our French colleagues in Indo China. They claim to have altered the properties of the latex by copper injection, and also to have increased the yield of rubber.

Although prevention is better than cure, we must consider, for immediate practical purposes, remedies which are known to be effective. The usual method is to add anticoagulants (such as small quantities of ammonia) to the latex in the tapping cups and collecting buckets. The nature of these anticoagulants must be such that on the above interpretation for the mechanisms involved, the clotting process is prevented by killing the responsible enzymes and the fermentation process delayed both by destroying the causative bacteria and by neutralising the acids produced.

Since the clotting mechanism starts as soon as the tree is tapped, it is necessary to add the preservative as soon as possible, especially with unstable latex. This, as most planters know to their cost, is exceedingly difficult to insure. To prevent contamination by bacteria it is essential to keep all cups, buckets, tanks and other utensils spotlessly clean and frequently sterilised with antiseptic chemicals, such as formaldehyde and paranitrophenol (PNP). In wet weather anticoagulants are again effective but what is required is a waterproof tree or a latex resistant to the action of the soluble bark substances.

It will be seen from the above that there are quite a few problems still to be solved on this subject and the chemists at the Rubber Research Institute are actively concerned in their elucidation. However, what is first required is a complete understanding of the complicated biological structure of latex and of the various mechanisms whereby the latex coagulates. It is to be hoped that this scientific insight will shortly be forthcoming, to the material convenience and financial benefit of the planting community in particular, and of rubber users in general.

CHEMICAL DIVISION

Packing of Samples for Examination by Chemical Division

SAMPLES RECEIVED from estates and factories for examination at the R.R.I. are often inadequately packed. In many instances the containers and contents are damaged during transit, making the latter useless for test purposes. These notes are intended to guide estates as to how samples can best be packed to avoid such damage. A similar article, devoted to biological specimens, will appear shortly.

AMMONIATED LATEX Samples of latex forwarded to R.R.I. for examination should be preserved with three quarters of a fluid ounce of 25% ammonia solution per pint of field latex, stating the quantities added. The amount of latex required for testing is about one pint. Bottles containing latex should be fitted with good corks and sealed with paraffin wax or sealing wax. In order to guard against breakages in transit, we suggest that bottles containing latex should be packed in a wooden case, with sufficient packing material to hold the bottles firmly, spaced well apart, and away from the sides, top and bottom of the case. Wood shavings and sawdust have been found satisfactory as packing materials.

ACETIC ACID AND FORMIC ACID The quantity of acetic and formic acid required for examination is four fluid ounces. The bottle containing the acid should be securely sealed and packing instructions for latex samples should be followed.

SODIUM SULPHITE AND SODIUM BISULPHITE Sodium sulphite and sodium bisulphite deteriorate rapidly when exposed to moist air. The material should be thoroughly mixed before sampling from a drum, since a sample from the surface of the drum may well have deteriorated. The sample should be packed in a clean cigarette tin, so that the tin is filled completely and the lid sealed around with adhesive tape to keep the contents airtight during transit.

SIMPLEXOMETERS AND METROLACS Simplexometers and metrolacs are sometimes forwarded to the R.R.I. for testing in cardboard or tin cases and a number of instruments so packed have been broken or damaged during transit. It is preferable to pack the cases containing the simplexometers or metrolacs in wooden boxes with sufficient packing material such as wood shavings or sawdust, and so avoid damage during transit. For brass instruments a wooden case may perhaps be dispensed with for shorter journeys, the instrument enclosed in its case being well covered with packing material and wrapped in stout brown paper. Glass instruments, however, must be packed in sawdust contained in wooden cases.

GENERAL In sending samples the following general points should be particularly observed.

1 Make sure that the sample you send is representative of the bulk material you wish to be tested. This can most readily be done by very thorough mixing of the material before removing a sample.

2 Please take great care that the container into which the sample is placed is scrupulously clean and dry.

3 We often have trouble with labels torn off or defaced in transit. Please insure that the label contains sufficient information to identify the sample (*i e* name of estate or factory and a reference number), is clearly written and is very firmly attached to the container. One stick-on label and one tie-on label per sample is a good practice.

4 A separate covering letter should always be sent requesting and detailing the tests required. It is a great help for our records if as much information as you have about the material to be tested is included in the letter. We are usually able to give a much better interpretation of test data if we have full information regarding the nature of the material examined. A covering letter also enables us to anticipate the arrival of samples and plan our testing work accordingly.

Reprints of this article may be obtained on request.

CHEMICAL DIVISION

A Rough Test for Bale Coating Powders

MUCH CONFUSION is caused by the fact that several powders used for bale coating compositions are very similar in appearance to certain substitutes and adulterants which appear on the market for this purpose, but which are not acceptable by rubber consumers' standards. The confusion is deepened by the many names of these powders some of which are used loosely to include both legitimate bale coating powders and substitutes.

The specification for powders for use in bale coating solutions adopted by the Rubber Manufacturers' Association Inc and endorsed by the Rubber Trade Association of New York Inc, in the U.S.A., says that talc or calcium carbonate may be used providing the following physical specifications are met:

a The powders must give 100% penetration when washed through a standard U.S. Sieve No. 100 and 93% penetration through a standard U.S. Sieve No. 325.

b The specific gravity of the powders may range from 2.60 to 2.90.

c The slip characteristics must range from good to excellent.

These physical properties are easily met by a wide range of powders and cannot in themselves indicate whether a given material is talc, calcium carbonate or a substitute.

TALC, when pure, is a hydrous magnesium silicate (in chemical language $H_2Mg_3Si_4O_{12}$); other names for this material are magnesium silicate, fibrous talc, steatite, soapstone and french chalk.

CALCIUM CARBONATE ($CaCO_3$) is known also as whiting, limestone, calcite, marble, calc spar, and Paris white.

One of the most common substitutes for talc and calcium carbonate is CHINA CLAY ($H_4Al_2Si_2O_9$), a hydrous aluminium silicate also called kaolin, argilla, white bole, pipe clay, porcelain clay, Cornish clay and porcelain earth.

These three materials may be differentiated quickly and with considerable certainty by two simple tests. The first test is the behaviour on wetting with water and the second the effect on the powder of dilute acid. Though not guaranteed to be absolutely infallible, as only complete chemical analyses can give the correct composition, application of these tests on the estate can be a very good guide and prevent the use of poor or useless bale coating materials.

WETTING TEST Place about an inch of water in a test tube, jam-jar or ordinary glass tumbler, drop a pinch (about enough to stay on a 5 cent piece) of the baling powder onto the surface of the water. Swirl the water very gently. Calcium carbonate and china clay are wetted almost immediately and fall to the bottom of the glass. Talc remains on the surface forming a skin and is not wetted. Even after vigorous swirling the soaplike scum of talc will still remain at the surface. A rough estimate of the amount of wetted material (calcium carbonate and/or china clay) may be made from the quantity of material which settles at the bottom of the vessel.

ACID TEST To the glass containing the powder add a 10% solution of hydrochloric, acetic or formic acid (*Not* sulphuric acid) in about equal volume to the water already present. Talc on the surface and china clay at the bottom are unaffected. Calcium carbonate at the bottom dissolves rapidly with evolution of bubbles of gas and finally gives a clear solution. If only calcium carbonate is present no residue will remain at the bottom of the glass. If china clay only is present there will be no reaction. If both are present, there will be a reaction and an estimable residue of china clay.

In the event of the above tests indicating that a given powder contains material other than talc or calcium carbonate, steps should be taken to confirm the nature of the powder before using it for bale coating.

Reprints of this article may be obtained on request.

CHEMICAL DIVISION

R R I Circulars : Obsolescence

As stated in our Editorial in the last issue, it is intended to revise R R I Circulars and to publish them in the Planters' Bulletin. The numbered series of circulars will therefore be discontinued at the end of 1952 and future material will be found in these pages.

You are recommended to keep this Bulletin for future reference. In due course we hope to be able to provide some form of ready binder to preserve issues together. Additional reprints of certain articles will be available on request; application is advised early after their appearance in the Bulletin. Whenever reprints are prepared a note will be found at the end of the article. Ready reference to the New Series of the Planters' Bulletin may be made by means of the issue number, *e.g.* P.B.2 for this issue. Page numbering will recommence with each new year.

Meanwhile, the last of the numbered series of R R I Circulars are in preparation, and the following addition to the list given on p.20 of our last issue (P.B.1) may be noted:

34 Note on Clone L.C.B. 1320

35 Application of the R.R.I. Bleaching Process to the Preparation of White Latex Crepe

36 Stump Poisoning and Root Disease

37 Choice of Clones and Clonal Seedlings; Planting Recommendations for 1952-3

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